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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/864,714	05/23/2001	Ajit P. Paranjpe	021208.0238	1724

31625 7590 07/14/2003

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EXAMINER
RAO, SHRINIVAS H

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 07/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/864,714	PARANJPE ET AL.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 April 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Response to Amendment

Applicants' amendment filed on April 30, 2003 has been entered on May 07, 2003.

Therefore claims 3 and 6 as amended by the amendment and claims 1-2, 4-5, and 7-26 as originally filed are currently pending in the Application.

Non-elected Claims 27 to 32 have been cancelled by the amendment.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102 (e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1 and 10-12 are rejected under 35 U.S.C. 102(e) as being anticipated by Kim (U.S. Patent No. 6,335,240, herein after Kim).

With respect to claim1, Kim describes a method of fabricating a conformal film on a substrate, the method comprising the steps of : depositing a film of predetermined thickness on the substrate by performing a predetermined number of atomic layer deposition cycles in a processing chamber, (Kim fig. 1 # 400, col. 4 lines 25-29) each atomic layer deposition cycle comprising : dosing the substrate with a precusor to establish a mono layer of the precursor on the substrate (Kim in col. 5 lines 54- -56 and col. 3 lines 13-16, as also previously stated under rejection of claims 7 and 8 below) describes the identical process using the same starting materials including the precursor- trimathylaluminum and water vapor using the same ALD process to form the same layer , therefore what is true for applicants' namely forming a monolayer of precusor on the substrate is also true for the Kim reference) dosing the substrate with a reactant to deposit an atomic layer deposition film (Kim col. 4 lines 30-34) and annealing the substrate after a predetermined number of atomic layer deposition cycles. (Kim col. 6 lines 38-40).

With respect to claim 10, wherein the atomic layer deposition cycle deposits a film having a thickness of approximately 0.8 A^0. (Kim col. 5 line 49).

With respect to claim 11, wherein the precursor comprises a trimethyl aluminum, the reactant comprises water and annealing further comprises annealing in a reactive ambient comprising oxygen. (Kim col. 5 line 54, col. 5 lines 55-56 and Kim col. 3 lines 13-16).

With respect to claim 12, wherein the annealing comprises a rapid thermal anneal. (Kim col. 5 lines 19-20).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2-9 and 13-14 and 16-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (U.S. Patent No. 6,335,240, herein after Kim) as applied to calim1 above and further in view of Seutter et al. (U.S. Patent Publication No. 2002/0106846 herein after Seutter).

With respect to claim 2, wherein annealing further comprises plasma annealing the substrate.

Kim describes annealing the substrate without specifying the particular annealing method used.

Seutter, a patent from the same filed of endeavor, describes in paragraph 0058 page 5 lines 6 to 16 plasma annealing method to reduce the nitrogen content in the neighboring layers which in turn reduces the resistivity of the device, for densifying the dielectric layer and thus making a better device.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use Seutter's annealing by plasma treatment instead of Kim's unspecified annealing in Kim's method to reduce the nitrogen content in the neighboring layers which in turn reduces the resistivity of the device, densifying the dielectric layer and thus making a better device. (Seutter para 58, page 5).

With respect to claim 3, wherein annealing the substrate further comprises performing plural plasma anneals, wherein the frequency of the anneals controls the intrinsic film stress from tensile to compressive. (Kim col. 4 lines 32-35).

With respect to claim 4, wherein annealing the substrate further comprises performing plural plasma anneals, wherein varying the frequency of the annealing controls the intrinsic tensile and compressive film stress (Kim col. 4 lines 19-24).

With respect to claim 5, wherein the annealing further comprises plasma annealing in a reactive ambient. (Seutter para 58 lines 4-5).

With respect to claim 6, wherein annealing further comprises plasma annealing the substrate in a reactive ambient every 25 to 50 A^0 of the film deposited . (Seutter para 60, page 5).

With respect to claim 7, further comprising heating the substrate to a temperature sufficiently low so that the mono layer of precursor adsorbed on the substrate is not thermally dissociated. (Seutter para 61 last 4 lines).

With respect to claim 8, wherein the precursor comprises tri methyl aluminum and the substrate is heated to a temperature within the range of between 60 degrees Celsius and 350 degrees Celsius. (Kim col. 5 lines 54-64).

With respect to claim 9, wherein substrate temperature is approximately 150 to 200 degrees Celsius. (Kim col. 5 lines 59-60).

With respect to claim 13, wherein the annealing comprises an in-situ plasma anneal. (Seutter para 0061 plasma within chamber i.e. in-situ).

With respect to claim 14, wherein the plasma anneal comprises heating the substrate with an RF source in an Ar/O_2 ambient.(Seutter para 0058 page 5- Ar ambient, RF –source well known in the art).

With respect to claim 16, wherein the dosing the substrate with a precursor further comprises flowing the precursor from a first zone of a multi-zone shower head and dosing the substrate with a reactant further comprises flowing the reactant from a second zone of a multi-zone showerhead. (Seutter paras 24 and 25).

With respect to claim 17, a method for fabricating a thin ALO_x film on a substrate with a precursor and atomic layer deposition, the method comprising : heating the substrate to a temperature so that precursor adsorbed on the substrate is not thermally dissociated (Seutter para 61 last 4 lines) and performing plural atomic layer deposition cycles, each cycle comprising deposition of ALO_x by reacting a mono layer of precursor on the substrate with a reactant (Kim col. 4 lines 32-35) ; and annealing the ALO_x film in a reactive ambient at one or more predetermined film thickness. (Seutter para 60, page 5).

With respect to claim 18, wherein the precursor comprises trimethyl aluminum.(Kim col. 5 lines 54-64).

With respect to claim 19, wherein the substrate temperature comprises approximatley 200 degree Celsius or less. (Kim col. 5 lines 54-64).

With respect to claim 20, wherein the reactant comprises water.(Kim col. 5 lines 55-56).

With respect to claim 21, wherein the precursor flows from a first zone of a multi zone showerhead and the reactants flows a second zone of the multi-zone showerhead. (Seutter paras 24 and 25).

With respect to claim 22, wherein annealing further comprises annealing the ALO_x approximately every 25 to 50 A^0 of thickness. (Seutter para 60, page 5)

With respect to claim 23, wherein annealing comprises in-situ annealing in a reactive ambient. (Seutter para 0061 plasma within chamber i.e. in-situ).

With respect to claim 24, wherein the reactive ambient comprises Ar/oxygen that oxidizes impurities associated with the ALO_x film. .(Seutter para 0058 page 5- Ar).

With respect to claim 25, wherein the film comprises a gap layer for a thin film head.(Kim figs. 3,4).

With respect to claim 26, wherein the film comprises a tunnel barrier in a magnetic tunnel junction. (Seutter para 0005).

B. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim (U.S. Patent No. 6,335,240, herein after Kim) and Sutter et al. (U.S. Patent Publication No. 2002/0106846 herein after Seutter) as applied to the claims above and further in view of Yamada et al. (U.S. Patent no. 5,616,177 herein after Yamada).

With respect to claim 15, further comprising maintaining a 50/500 dose to adsorption ratio.

Kim and Seutter describe a film, but do not describe a 50/500 dose to adsorption ratio.

However, Yamada a patent from the same filed of endeavor, describes in col.5 lines 29-37 dose to concentration (adsorption) ratio of between 2:1 to 8:1 to produce a semiconductor having excellent characteristics, a low threshold voltage and a low operating voltage.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include Yamada's dose to adsorption ratio in Kim and Suetter's method to produce a semiconductor having excellent characteristics, a low threshold voltage and a low operating voltage. (Yamada col. 2 lines 28-40).

Further it would have been obvious to one of ordinary skill in the art at the time of the invention to use a 50/500 i.e. 1:10/ 10 :1 ratio without a showing of criticality or unexpected results because it was previously done by Yamada between 2:1 to 8:1.

Response to Arguments

Applicant's arguments filed 5/07/03 have been fully considered but they are not persuasive for the following reasons : .

Applicants' contention that Kim does not teach the step of , " dosing the substrate with a precursor to establish a monolayer of the precursor on the substrate" is not persuasive because Kim in col. 5 lines 54- -56 and col. 3 lines 13-16, as also previously stated under rejection of claims 7 and 8 above describes the identical process using the same starting materials including the precursor- tri methyl aluminum and water vapor using the same ALD process to form the same layer(same purpose) , therefore what is true for applicants' namely forming a mono layer of precursor on the substrate is also true for the Kim reference.

Applicants' argument that claims 10-12 must be allowable because they depend from allegedly allowable claim1 is not persuasive, as shown above claim 1 is not allowable therefore claims 10-12 are also not allowable.

Applicants' contention that claim 17 is allowable because the applied references fail to teach/suggest the recited steps namely, " performing plural atomic layer deposition cycles comprising deposition of AlO_x by reacting a mono layer of precursor on the substrate with a reactant" is not persuasive because Kim in col. 4 lines 32-35 col. 5 lines 40- 56 and col. 3 lines 13-16 discloses the step of performing plural atomic layer deposition cycles comprising deposition of AlO_x by reacting a mono layer of precursor on the substrate with a reactant.

Therefore claim 17 is not allowable.

Dependent claims 2-9 and 13-16 and 18-26 were alleged to be allowable because of the dependency upon allegedly allowable claims 1 and 17, however as shown above claims 1 and 17 are not allowable and therefore dependent claims 18-26 are also not allowable.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Steven H. Rao whose telephone number is (703) 306-5584. The examiner can normally be reached on Monday- Friday from approximately 7:00 a.m. to 5:00 p.m.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. The Group facsimile number is (703) 308-7724.

SHR
7/7/03

SUPERVISORY PRIMARY EXAMINER
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